

Appl'n No.: 09/677,304

1. (Amended) A piezoelectric/electrostrictive device comprising:
 - a pair of mutually opposing thin plate sections made of metal and a fixation section for supporting said thin plate sections;
 - an object attached to forward end portions of said pair of thin plate sections;
 - and
 - one or more unimorph piezoelectric/electrostrictive elements arranged on at least one thin plate section of said pair of thin plate sections, said at least one thin plate section defining a substrate for each respective unimorph piezoelectric/electrostrictive element, wherein:
 - an areal size of a surface of said object opposed to said thin plate section is larger than an areal size of an object attachment surface of said thin plate section.

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Paragraph beginning at line 10 of page 1 has been amended as follows:

Description of the Related Art:

Recently, a displacement element, which makes it possible to adjust the optical path length and the position in an order of submicron, is required, for example, in the fields of the optics, the magnetic recording, and the precision machining. Development is advanced for the displacement element based on the use of the displacement brought about by the inverse piezoelectric effect or the electrostrictive effect caused when a voltage is applied to a piezoelectric/electrostrictive material (for example, a ferroelectric material).

Paragraph beginning at line 13 of page 2 has been amended as follows:

On the other hand, Japanese Laid-Open Patent Publication No. 63-64640 discloses a technique in relation to an actuator based on the use of a bimorph. In this technique, electrodes for the bimorph are provided in a divided manner. The actuator is driven due to the selection of the divided electrodes, and thus the highly accurate positioning is performed at a high speed. This patent document (especially in FIG. 4) discloses a structure in which, for example, two bimorphs are used in an opposed manner.

Paragraph beginning at line 26 of page 4 has been amended as follows:

Especially, in the present invention, the device is excellent in strength and toughness, and the device is capable of responding to any quick displacement action, because the thin plate section is made of metal. Therefore, according to the present

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invention, it is possible to sufficiently respond to any variation of the environment of the-use and any severe state of the-use. It is possible to realize a long service life of the piezoelectric/electrostrictive device, and it is possible to contemplate the handling performance of the piezoelectric/electrostrictive device. Further, the thin plate section can be greatly displaced at a relatively low voltage, and it is possible to achieve the realization of a high speed of the displacement action of the thin plate section (realize a high resonance frequency).

Paragraph beginning at line 13 of page 11 has been amended as follows:

The voltage is applied to the pair of electrodes 24, 26 via terminals (pads) 28, 30 of the respective electrodes 24, 26 formed on ~~the~~ both side surfaces (element formation surfaces) of the fixation section 14 respectively. The respective terminals 28, 30 are positioned as follows. That is, the terminal 28 corresponding to the first electrode 24 is formed at the position deviated toward the rearward end of the fixation section 14. The terminal 30 corresponding to the second electrode 26 disposed on the side of the external space is formed at the position deviated toward the inner wall of the fixation section 14.

Paragraph beginning at line 24 of page 11 has been amended as follows:

In this embodiment, the piezoelectric/electrostrictive device 10 can be individually fixed by utilizing the surfaces respectively different from the surfaces on which the terminals 28, 30 are arranged. As a result, it is possible to obtain ~~the~~ high reliability for both of the fixation of the piezoelectric/electrostrictive device 10 and

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the electric connection between the circuit and the terminals 28, 30. In this arrangement, the electric connection between the terminals 28, 30 and the circuit is made, for example, by means of the flexible printed circuit (also referred to as FPC), the flexible flat cable (also referred to as FFC), and the wire bonding.

Paragraph beginning at line 7 of page 18 has been amended as follows:

In this embodiment, the piezoelectric/electrostrictive element 20a, 20b is constructed to have the piezoelectric/electrostrictive layer 22 and the pair of electrodes 24, 26 which are formed on the both sides of the piezoelectric/electrostrictive layer 22. The first electrode 24 of the pair of electrodes 24, 26 is formed directly on at least the side surface of the thin plate section 12a, 12b by the aid of the adhesive 104. Accordingly, the vibration, which is caused by the piezoelectric/electrostrictive element 20a, 20b, can be efficiently transmitted to the object 18 via the thin plate section 12a, 12b. Thus, it is possible to improve the response performance. Therefore, it is desirable that the adhesive 104 scarcely inhibits the vibration of the piezoelectric/electrostrictive element 20a, 20b.

Paragraph beginning at line 14 of page 19 has been amended as follows:

In the piezoelectric/electrostrictive device 10, the shape of the piezoelectric/electrostrictive device 10 is unlike the conventional device, i.e., not the plate-shaped configuration (the thickness in the direction perpendicular to the displacement direction is small)-~~unlike conventional one~~. Each of the object 18 and the fixation section 14 has the rectangular parallelepiped-shaped configuration (the

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thickness in the direction perpendicular to the displacement direction is large). The pair of thin plate sections 12a, 12b are provided so that the side surface of the object 18 is continuous to the side surface of the fixation section 14. Therefore, it is possible to selectively increase the rigidity of piezoelectric/electrostrictive device 10 in the Y axis direction.

Paragraph beginning at line 19 of page 21 has been amended as follows:

As described above, the thin plate section 12a, 12b is the portion which is driven in accordance with the displacement of the piezoelectric/electrostrictive element 20a, 20b. The thin plate section 12a, 12b is the thin plate-shaped member having flexibility, and it functions to amplify the expansion and contracting displacement of the piezoelectric/electrostrictive element 20a, 20b arranged on the surface as the bending displacement and transmit the displacement to the object 18. Therefore, it is enough that the shape or the material of the thin plate section 12a, 12b provides the flexibility with the mechanical strength of such a degree that it is not broken by the bending displacement. It is possible to make appropriate selection considering the response performance and the operability of the object 18.

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